

Surge Protectors for Photovoltaic systems

Most photovoltaic module manufacturers guarantee their materials for 20 years or more. The ROI of photovoltaic generation facilities connected to the low voltage network is therefore calculated over this long period of time. But these systems are often highly exposed to lightning and power surges, which can greatly reduce the required operating time. Implementation of appropriate protection solutions is strongly recommended.

Several points must be considered to analyze the risk «Lightning and Power Surges»:

- Due to the exposed nature of the PV array, the threat of «lightning» is more common.
- The risk is multiple: direct effect (lightning strike on the panels) and indirect (surge on cells, solar chargers / inverters), on other lines (data).
- The operating loss must be taken into account, especially at sites of high power capacity.
- When the PV system is located on industrial sites, the risk of switching overvoltages must also be taken into account. The level of risk is directly related to the lightning density and exposure of local lines

Protection of PV installation

The photovoltaic grid-connected low voltage power lines may be subject to overvoltages on different networks:

- **AC network:** surge protectors are necessary, and in most cases, mandatory on the AC output of the PV inverter which is connected back to the AC power grid.
- **DC network:** surge protectors are required or mandatory on the input of the PV inverter or the input of the PV modules.
- **Communication network:** if the PV inverter is connected to signal lines (probes, sensors, monitoring) then surge protectors are highly recommended on these networks.

AC surge protectors for PV installation

Depending on the type of networks, the presence of lightning rod or primary surge protectors existing, CITEL offers a complete range of solutions to protect the AC part of the PV system.

Installations with lightning rods

A Type 1 surge protector, specifically dimensioned to handle direct lightning current is required at the service entrance of the installation (main switchboard). Surge protectors like the DS130R provide a high energy surge capacity in a compact size and are easily serviced with pluggable modules.

Standard installation

In the absence of lightning rod, the implementation of a type 2 SPD is generally preferred, but, in some cases, it is compulsory depending on the level of lightning in the area ($N_g > 2.5$). The DS40 type 2 arrester range offers a modular solution adapted to these applications. For medium and small size facilities with limited space available, the DS240/DS440 provides a high surge capacity in a reduced footprint.

Input protection of PV inverter

CLC/TS 50539-12 guide requires the implementation of an additional SPD on the AC input of the PV inverter, if it is more than 10 m from the primary surge protector. The DS215/DS415 surge protectors provide this protection for these applications and can be installed either directly into the distribution panel or in a dedicated, standalone enclosure solution.

Surge protectors for datalines

The PV system can be interconnected to various datalines networks including probes, sensors, and monitoring equipment. In these cases, the implementation of suitable surge protectors is highly recommended: The DLA range performs this function and is available for any type of telecom or data line connections

DC surge protectors for PV installation

The DC input of the PV inverter has to be protected according to the recommendation of the CLC/TS 50539-12 Guide. CITEL has designed a complete range of Type 1 and Type 2 surge protectors for these applications that are compliant with the EN 50539-11 product standard.

Type 1 surge protectors





When the installation is equipped with lightning rods or for open free PV fields (see CLC/TS 50539-12), it is mandatory to install SPD dimensioned for a direct lightning impulse (10/350 μ s). In these cases, CITEL has developed a range of high energy Type 1 surge protectors:

- **DS60VGPV/51 series** : Type 1 SPDs may withstand @10/350 μ s up to 12.5 kA by pole (Iimp) and 25 kA (Itotal), it incorporates CITEL's exclusive, patented «VG Technology». Comply with EN50539-11 product test.
- **DS50PV/12KT1 and DS50VGPV/12KT1 series** : These Type 1 pluggable SPDs have a current total of 12.5 kA (Itotal) and are required when the likely direct current lightning is not maximal.

Type 2 surge protectors

In most installations, the SPD will be necessary or obligatory and will be of type 2. CITEL offers 3 ranges with pluggable module design:

- **DS50PV series** : based on the use of specific varistors, providing a protection in common mode or differential and common mode.
- **DS50PV/51 series** : based on the use of specific varistors, providing a protection in common mode or differential and common mode. Comply with EN50539-11 product test.
- **DS50VGPV/51 series** : This version is based on VG technology, insuring a total absence of leakage current and maximum reliability. Comply with EN50539-11 product test.

Series		Description	Characteristics	Page
DS60VGPV		Type 1+2 surge protector for PV	High energy VG Technology	69
DS50PV/12KT1 DS50VGPV/12KT1		Type 1+2 surge protector	Pluggable	70
DS50VGPV		Type 2 surge protector for PV	Pluggable VG Technology	71
DS50PV		Type 2 surge protector for PV	Pluggable	72

Protection of isolated (off-grid) PV systems

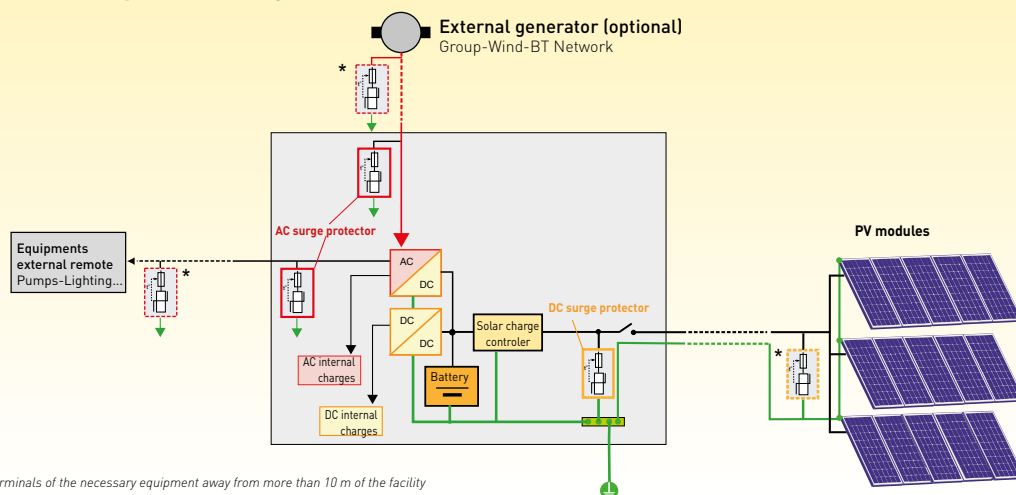
The exposure and location of remote sites powered by isolated PV systems not connected to the AC network are at a very high risk of failure due to transient surges.

Unlike the sites connected to the distribution network, PV equipment failure at a remote site will result in a total operating loss: thus, the implementation of appropriate surge protection is strongly recommended.

The selection and installation of surge protectors for off-grid sites will be defined in the UTE C15-712-2 guide.

CITEL surge protectors for remote sites are available in voltages from 12 to 350Vdc.

Surge protection for PV powered off-grid installation



**) surge arrester at the terminals of the necessary equipment away from more than 10 m of the facility*

DS50PV/51, DS50VGPV/51 and DS5VP/12KT1 series

Pluggable module

Disconnection for simplified maintenance. Standardized marking



Connectors

Significant physical separation screw terminal blocks: ensuring insulation between polarities even for high DC voltages



Status signaling

In case of safety disconnection, the indicator switches to red: module to replace.



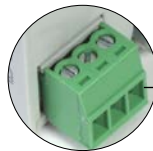
Versions

several diagrams available DS50PV/51 and DS50VGPV



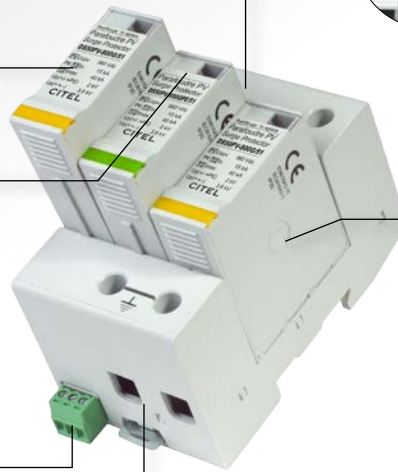
Remote signalling

Option to remotely monitor the status of the surge protector. Simplified cabling thanks to a single terminal for monitoring all poles.



Earth

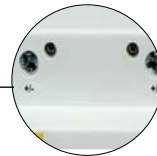
Double connector for optimized connection ground network.



DS60VGPV/51 series

Connectors

Significant physical separation screw terminal blocks: guarantee insulation between polarities even for high DC voltages



VG Technology

Efficiency and reliability maximum



Remote signalling

Standard feature to remotely monitor the status of the surge protector. Simplified cabling thanks to a single terminal for monitoring all poles.



Status signaling

In case of safety disconnection, the indicator switches to red: SPD to replace.



Protection of Photovoltaic installations

Residential Photovoltaic installation

The CLC/TS 50539-12 installation guide gives the relevant information to manage the safe operation of PV installation in case of surge due to lightning. For small power plants (residential and small commercial), AC input (connection to the grid) and DC out should be protected.

The implementation of the SPD may be mandatory for some cases. However, if the reliability and longevity of the PV system are the primary objective then the implementation of surge protectors is always recommended.



Business/Building Photovoltaic installation

Commercial or industrial sites can integrate very large photovoltaic systems into their power generation strategy. These applications are vulnerable to lightning and transient surges which can cause significant downtime and losses. The implementation of SPDs at key locations throughout the facility is necessary to ensure the reliable operation of the plant.



Photovoltaic Power Plant

Photovoltaic power plants have a high risk of lightning strikes due to their large surface area and exposed location. This means expensive, sensitive equipment is vulnerable to lightning strikes resulting in direct replacement costs and operation downtime losses. Thus implementation of SPDs on AC, DC and communication lines are highly recommended.

